[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the especially suitable optical disk media for the recording and reproducing device of optical disk media which record or play the information recorded on two or more recording layers from one side, such as a digital versatile disc (DVD:Digital Versatile Disc), and this device.
[0002]
[Description of the Prior Art]The minute hollow called the pit corresponding to recorded information to the field of one side of transparent resin boards is formed, The focus of a laser beam is doubled with a pit sequence through transparent resin boards, and CD (Compact Disc) is raised as a typical example as an optical disc which plays a recording medium by change of the reflected light quantity of a laser beam.
[0003]CD is a 1.6-micrometer track pitch at transparent resin boards (120 mm in diameter, and 1.2 mm in thickness), and the pit sequence of about 0.9 micrometer of shortest pit length is formed. The linear velocity at the time of playback is constant at about 1.3 m/s, it has the storage capacity of about 650 M bytes, and digital data, such as music and an image, is memorized.
[0004]CD is a single plate structure which comprises one transparent resin boards, and has only one information surface. The label in which reproduction expresses a disk title etc. with the surface of an opposite hand the laser incidence side of transparent resin boards since laser radiation is performed through transparent resin boards is printed.
[0005]On the other hand, development of DVD which raised storage density by about 7 times the CD is progressing. DVD is large volumetric DVD which records the video audio signal which was developed and was digital-signal-ized as a medium of the next generation of an optical disc, and the data for computers. In order to secure the large scale, some new technology which raises the storage density on an optical disc conventionally is used for a digital versatile disc. For example, the thickness of a substrate shall be 0.6 mm, pastes two substrates together, and constitutes a 1.2-mm-thick optical disc. In this case, information can be recorded on each substrate and one side two-layer reproduction etc. can be performed. There is specification of DVD-5, 9, 10 and 18, and many in DVD with storage capacity or a function.
[0006]Drawing 8 is some sectional views of the disk of one side playback 1 layer system. As for a transparent substrate and 52, 50 are [a glue line and 66] pickups a reflecting layer and 53 a substrate and 51 among a figure. After forming the reflecting layer 52 in the transparent substrate 51 by which the pit sequence was formed in the upper surface, it pastes together to the substrate 50 by the glue line 53. The metal in which the reflecting layer 52 reflects most laser beams, such as aluminum (aluminum) and gold (Au), is used. For example, it has composition on which the substrate (120 mm in diameter and 0.6 mm in thickness) was stuck by the glue line about 50 micrometers thick as well as transparent resin boards (120 mm in diameter, and 0.6 mm in thickness). As for the information storage layer in which this reflecting layer 52 was formed, reproduction is performed by the pickup 66 from the transparent substrate 51 side. The thing of such one side reproduction is called DVD-5.
[0007]Drawing 9 is some sectional views of the disk of double-sided playback 1 layer system. As for a transparent substrate, and 52 and 55, a glue line and 66 are pickups a reflecting layer and 53 51 and 54 among a figure. This disk pastes together the transparent substrate 51 in which the reflecting layer 52 explained by drawing 8 was formed, and the transparent substrate 54 in which the reflecting layer 55 was formed by the glue line 53 from both sides. As for the information storage layer of this disk,

playback is performed by the pickup 66 from the transparent substrate 51 and 53 side, respectively. Such a disk is called DVD-10.

[0008]To that by which the information storage side of one layer was formed in one side or both sides which were mentioned above, there is a disk of two-layer structure, ** of one side playback two-layer structure is called DVD-9, and the thing of double-sided playback two-layer structure is called DVD-18.

[0009]Drawing 10 is some sectional views of the disk of one side playback two-layer structure. As for the 2nd transparent substrate and 64, the 1st transparent substrate and 62 are [a transparent glue line and 66] pickups a reflection film and 65 a translucent reflective layer and 63 61 among a figure. A pit sequence is formed in the upper surface of the 1st transparent substrate 61, and it is covered with the translucent reflective layer 62. A pit sequence is formed also in the upper surface of the 2nd transparent substrate 63, and it is covered with the reflection film 64. The 1st transparent substrate 61 and 2nd transparent substrate 63 are stuck via the transparent glue line 65. The interval of each information storage layer is about 50 micrometers.

[0010]The 1st information storage layer (layer 0) that consists of a pit sequence of the upper surface of the 1st transparent substrate 61 covered with the translucent reflective layer 62 by the pickup 66 is reproduced, The 2nd information storage layer (layer 1) that consists of a pit sequence of the upper surface of the 2nd transparent substrate 63 covered with the reflection film 64 by the pickup 66 is reproduced. Two information storage layers can be switched and read by whether a focus is doubled with either the 1st information storage layer (layer 0) or the 2nd information storage layer (layer 1), usually using one pickup as the pickup 66.

[0011]Drawing 11 is some sectional views of the disk of double-sided playback two-layer structure. the inside of a figure, and 61 -- the 1st transparent substrate and 62 -- a translucent reflective layer and 71 -- a transparent resin layer and 72 -- as for a transparent resin layer and 74, the 2nd transparent substrate and 68 are [a glue line and 66] pickups a reflection film and 75 a translucent reflective layer and 73 a reflection film and 67. A pit sequence is formed in the upper surface of the 1st transparent substrate 61, and it is covered with the translucent reflective layer 62. 2P (Photo Polymerization) law is used on the transparent resin layer 71 formed with ultraviolet curing resin on this translucent reflective layer 62, a pit sequence is minced, and it is covered with the reflection film 72. The same may be said of the 2nd transparent substrate 67 side. The 1st transparent substrate 61 and 2nd transparent substrate 67 carry out a read-out side outside, and are stuck via the glue line 75.

[0012]The 1st information storage layer (layer 0) that consists of a pit sequence of the upper layer of the 1st transparent substrate 61 covered with the translucent reflective layer 62 by the pickup 66 is reproduced, The 2nd information storage layer (layer 1) that consists of a pit sequence of the upper surface of the transparent resin layer 71 covered with the pickup 66 with the reflection film 72 is reproduced. The 1st and 2nd information storage layer is similarly reproduced by the pickup 66 about the 2nd transparent substrate 63 side.

[0013]Thus, one side two-layer playback is carried out by playing four layers of both sides, or turning an optical disc over. Two information storage layers can be switched and read by with which a focus shall be doubled for every one side between the 1st information storage layer (layer 0) or the 2nd information storage layer (layer 1), usually using one pickup as the pickup 66.

[0014]In 9, the 1st information storage layer (layer 0) and the 2nd information storage layer (layer 1) are formed on DVD[which was shown in drawing 10 among DVDs mentioned above]-the 1st transparent substrate 61 different, respectively and the 2nd transparent substrate 63, and the code track is formed in

spiral shape, respectively. It is not avoided that eccentricity comes out of each transparent substrate between a center hole and the code track of an information storage layer at the time of center hole formation. Being stuck with the eccentricity 0 is impossible, and when pasting together the 1st transparent substrate 61 and 2nd transparent substrate 63, the substrate center of two substrates shifts and will be stuck.

[0015]In a DVD reproducer, chucking of the optical disc to a spindle performs position **** with the centering ring on a turntable using the center hole (not shown) of the 1st transparent substrate 61 by the side of read-out. therefore, when lamination shifted, with the substrate which carried out position appearance and was carried out, there was a problem that the eccentricity of the 2nd information storage layer (layer 1) by the side of the 2nd transparent substrate 63 of an opposite hand became large.

[0016]In the case where, on the other hand, form the semi-transparent membrane 71 on the substrate with which the 1st information storage layer (layer 0) is formed by DVD-18 shown in drawing 11, and the 2nd information storage layer (layer 1) is formed in the transparent resin layer 72 on it by the 2P method, Since the center of the 2nd information storage layer (layer 1) shifted to the center of the track of the 1st information storage layer (layer 0) and eccentricity arose, there was a problem that the eccentricity of the 2nd information storage layer (layer 1) became large like DVD-9.

[0017]About 100 micrometers has the desirable maximum eccentricity of the 2nd information storage layer (layer 1) whose maximum eccentricity of the 1st information storage layer (layer 0) near the entrance plane of a laser beam is [as opposed to / in DVD-9 and DVD-18 / the center hole of a substrate] far from 70 micrometers and an entrance plane. In this case, in DVD-9, when DVD-18 becomes in the direction from which an eccentric direction is different 180 degrees between the 1st and 2nd information storage layer by the 2P method, the relative maximum eccentricity is permitted by lamination to 100micrometer+70micrometer=170micrometer. the case where the eccentric direction of the 1st and 2nd information storage layer becomes in the direction -- relative eccentricity -- a maximum of 100 -- it will approve to micrometer-70micrometer=30micrometer.

[0018]Drawing 12 is an explanatory view of the regeneration method of the two-layer structure disk of one side reading. As for the 2nd information storage layer and 83, 81 are [read out area and 85] middle area read in area and 84 the 1st information storage layer and 82 among a figure. The two-layer structure disk of one side reading is classified into two kinds, a parallel track path and an opposite track path, from the regeneration method.

[0019]First, the read out area 84 exists in the read in area 83 and an outer peripheral track on each inner circumference track of the 1st information storage layer 81 and the 2nd information storage layer 82, and, as for the optical disc of the parallel track path shown in drawing 12 (A), two-layer is played from an inner circumference track to an outer peripheral track.

[0020]On the other hand, the optical disc of the opposite track path shown in drawing 12 (B), It has 1 set of read in area 83, and the read out area 84 in an inner circumference track by two-layer, and from the path in which each class is almost the same, the middle area 85 exists and seamless reproduction has come be made in an outer peripheral track by return between outermost peripheries. That is, if it reaches to the middle area 85 after reproducing the 1st information storage layer 81 from an inner circumference track to an outer peripheral track, a layer jump will be carried out to the 2nd information storage layer 82, and the 2nd information storage layer 82 will continue reproduction toward an inner circumference track from an outer peripheral track.

[0021]This opposite track path is used when recording the program of a movie etc. for a long time

[continuous]. The continuous reproduction of a movie etc. becomes possible for a long time covering two-layer by securing the regenerative data outputted during a layer jump operation period beforehand to the prediction buffer memory, and carrying out a layer jump to the 2nd information storage layer 82 from the 1st information storage layer 81 quickly.

[0022]First, the jump to the start track of the 2nd information storage layer 82 of the 1st information storage layer 81 from an end track performs a layer jump by focal kick, next steps on the procedure of searching a start track, from the landing track of the 2nd information storage layer 82.

[0023]However, as the 1st information storage layer 81 and the 2nd information storage layer 82 have eccentricity, respectively and mentioned it above, the distance of 170 micrometers of worsts may exist from the layer jump landing site on the 2nd information storage layer up to a reproduction start track. In this case, first of all, the reproduction beam must carry out rough seek operation even to the position which used the track number and left about 230.

[0024]The time which a layer jump takes is +(track search time)+ (latency speed) (focusing jump time). It comes out. In order to ensure seamless reproduction motion, it is necessary to memorize beforehand only the regenerative data which covers this time to a buffer memory. Therefore, when track search took time, there was a problem that it was necessary to carry so a lot of buffer memories in playback equipment.

[0025]Focus control coincided to the position of the information storage layer which corresponds each light spot of two or more light sources in the playback equipment for reproducing information from the optical disk media which have the multilayer information storage layer which is indicated to JP,4-243024,A is performed. Focus control which coincides the spot of one light source to one position of arbitrary information storage layers in the playback equipment for reproducing information from the optical disk media which have the multilayer information storage layer which is indicated to JP,5-54396, A is performed. However, about tracking servo art which decreases the long seek distance resulting from the eccentricity between information storage layers at the time of the change of an information storage layer, nothing is taken into consideration about existence of the eccentricity between information storage layers.

[0026]

[Problem(s) to be Solved by the Invention]This invention was made in view of the situation mentioned above, and an object of this invention is to provide the optical-disk-recording playback equipment and optical disk media which can perform layer jump operation to other information storage layers [layer / one / information storage] at high speed. For example, also let it be the purpose to enable it to perform seamless reproduction motion certainly by few buffer memories.

[0027]

[Means for Solving the Problem]In optical-disk-recording playback equipment in which the invention according to claim 1 performs either [at least] record of two or more information storage layers, or playback from the one side side of multilayer-structure optical disk media, It has a focus servo means in which a change of an information storage layer made into an object of record or reproduction among said two or more information storage layers is possible, and a tracking servo means, When it is in a position where hand-of-cut position of eccentricity of an object information recording layer and eccentricity of an information storage layer after a change of a disc medium corresponds, while turning OFF said tracking servo means, A focus is switched to an information storage layer after a change, and it has a control means which makes said tracking servo means one.

[0028]In the optical-disk-recording playback equipment according to claim 1 the invention according to claim 2, A rotary place detection means of said optical disk media, and an eccentric direction detection means to detect eccentric direction information on said two or more information storage layers of each from a tracking error signal, It has a movement point calculation memory measure between layers which memorizes them, and computes and memorizes a rotation angle position eccentricity of an information storage layer before a change and whose eccentricity of an information storage layer after a change correspond mostly, Based on angular-position information memorized by this movement point calculation memory measure between layers, and angular-position information on said rotary place detection means, movement timings between information storage layers are obtained.
[0029]In the optical-disk-recording playback equipment according to claim 1 or 2, the invention according to claim 3 as movement timings between information storage layers, An intersection of eccentric data of the 1st information storage layer that shifted only the angle theta which optical disk media rotate, and eccentric data between the 2nd information storage layer is made within a time [required for movement between layers] with a layer move end point, and only theta makes a front angle the layer move starting point from the point.
[0030]In optical-disk-recording playback equipment of a statement, the invention according to claim 4 in any 1 paragraph of claims 1 thru/or 3 said rotary place detection means, A position of a hand of cut is detected by detecting an angle mark formed in a solid of revolution interlocked with a driving shaft which drives said optical disk media.
[0031]In optical-disk-recording playback equipment given in any 1 paragraph of claims 1 thru/or 3, the invention according to claim 5 detects a position of a hand of cut, when said rotary place detection means detects an angle mark formed in said optical disk media.
[0032]In optical disk media which have two or more information storage layers and with which either [at least] record or reproduction is performed from the one side side, the invention according to claim 6 has an angle mark which expresses a position of a hand of cut to a field of a peripheral part and its neighborhood.
[0033]
[Embodiment of the Invention]Drawing 1 is an outline lineblock diagram of the optical disk reproducing device of a 1st embodiment of the optical-disk-recording playback equipment of this invention. An optical disc and 2 among a figure a spindle motor and 3 the axis of rotation and 4 for one A rotary encoder, 5 -- photosensor and 6 -- an angle-of-rotation detector circuit and 7 -- as for a buffer memory and 11, a preamplifier and 9 are [an eccentricity measurement circuit and 13] microprocessors a servo circuit and 12 a decoded signal processing circuit and 10 a pickup and 8.
[0034]In the optical disk reproducing device of drawing 1, the rotary encoder 4 is attached to the axis of rotation 3 of the spindle motor 2 as an angle-of-rotation detection means, and the photosensor 5 for reading this is provided. When equipped with the optical disc 1 of two-layer structure like DVD-9 or DVD-18 using this angle-of-rotation measuring means and an eccentric detection means, Before going into reproduction motion, beforehand, the eccentric direction of the 1st and 2nd information storage layer is measured, respectively, the intersecting position and focusing jump timing of a track are computed by return by the microprocessor 13, and it memorizes in the memory provided in an inside or other circuit blocks.
[0035]At the time of the layer jump under playback of an optical recording medium, angle of rotation of the optical disc 1 is continuously supervised using the angle-of-rotation detector circuit 6, and jump

operation is performed according to the jump timing computed beforehand. That is, a focusing jump is carried out in the jumpstart position of the 1st information storage layer, and a tracking servo is drawn in the jump end position of the 2nd information storage layer. As a result, jump accuracy is improved and reproduction of a target track can be started quickly.

[0036]Here, explanation is added about the rotary encoder. Drawing 2 is a top view showing one example of a rotary encoder. As for three, a slit and 22 are reference slits the axis of rotation and 21 among a figure. Two or more slits 21 are formed by the equiangular distance as an angle mark for this rotary encoder to get to know the position of a hand of cut in accordance with the periphery of a disk. One slit in it is the reference slit 22 provided in 1 round only one. In other slits 21, the reference slit 22 changes at least one of shape, reflectance, and the transmissivity, and is formed. For example, by making width of the slit large, beginning the center of this width from the detection point in time of this basic slit 22 as a reference position of angle of rotation, and calculating the detection frequency of the slit 21, Angle of rotation of the rotary encoder 4, i.e., angle of rotation of the optical disc 1, is detectable.

[0037]Although the slit 21 and the reference slit 22 penetrate or reflect the light from the light source which is not illustrated in the linear portion of a slit, the black striped pattern which is made to shade light in the linear portion of a slit, or is not reflected conversely may be sufficient as them. As a thing similar to the latter, as indicated to JP,7-272394,A, What prints the stripes of light and darkness to the turntable down side holding an optical disc, detects catoptric light with photosensor, and detects the linear velocity of an optical disc is known, and such a turntable may be used.

[0038]Again, it returns and explains to drawing 1. Although the optical disc 1 is driven with the spindle motor 2, in this embodiment, the rotary encoder 4 with which the slit arranged equiangularly was recorded on the axis of rotation 3 is attached. This slit is read with the photosensor 5 and the position of the hand of cut of an optical disc is detected by the angle-of-rotation detector circuit 6. The pickup 7 and the servo circuit 11 can switch and read the track of the 1st information storage layer of the optical disc 1, and the 2nd information storage layer, and output a reading signal to the preamplifier 7. The pickup 7 moves to the diameter direction of the optical disc 1 with the head drive which omitted the graphic display. From the preamplifier 8, the regenerative signal according to a pit sequence pattern is outputted to the decoded signal processing circuit 9, and once decryption and other signal processing are made and it is accumulated in the buffer memory 10, it is outputted.

[0039]From the preamplifier 8, various kinds of detecting signals for control of the revolving speed of the spindle motor 2, control of tracking, control of a focus, etc. are outputted to the servo circuit 11. The servo circuit 11 outputs a signal also to the eccentricity measurement circuit 12 while it is taken up 7 and outputs a control signal to the spindle motor 2. This eccentricity measurement circuit 12 measures the eccentricity of the 1st information storage layer and the 2nd information storage layer from a tracking error signal, and outputs it to the microprocessor 13. The microprocessor 13 can know the eccentric state of an optical disc from the output and the angle-of-rotation detector circuit 6 of an eccentricity measurement circuit.

[0040]Drawing 3 is an explanatory view of the detecting operation of the eccentric state of the 1st [in this invention], and 2nd information storage layer. The figure of the signal with which drawing 3 (A) is outputted from photosensor to the slit of the rotary encoder 4, Drawing 3 (B) The wave form chart of the open tracking error signal of the 1st information storage layer, As for the wave form chart of the closed tracking error signal of the 1st information storage layer, and drawing 3 (D), the wave form chart of the

open tracking error signal of the 2nd information storage layer and drawing 3 (E) of drawing 3 (C) are the wave form charts of the closed tracking error signal of the 2nd information storage layer. The eccentric state of the 1st and 2nd information storage layer is measurable one by one by the following two kinds of methods from each tracking error signal (TER).

[0041]Drawing 3 (B) is a tracking error signal when a focus is carried out to the 1st information storage layer and a tracking servo is turned OFF. In the position (plus eccentric points, minus eccentric points) from which eccentricity serves as the highest in the position (zero eccentric points) used as the minimum, and eccentricity serves as the maximum, the frequency of this open tracking error signal serves as the minimum, and is turned up by turns. Thus, since open tracking error signal frequency expresses the eccentric state of the information storage layer, it can measure this as eccentric data frequency detection or by carrying out a periodic count.

[0042]Therefore, in the timing of the slit pulse from a rotation position sensor, the frequency of an open tracking error signal is detected using a filter, a counter or a detector circuit, etc., and data is incorporated into the microprocessor. At this time, the data for 1 round is incorporated in an order from the reference slit 22. Thus, the eccentric data of the 1st information storage layer of the optical disc 1 with which it equipped can be measured. Similarly, the eccentric data of the 2nd information storage layer can be measured from the open tracking error signal shown in drawing 3 (D).

[0043]Eccentric data can also be measured from a tracking error signal (TER) when a tracking servo as shown in drawing 3 (C) is made one. In a closed tracking error signal, the remains eccentric component of 1 for the loop gain of the eccentricity of the optical disc 1 appears. Therefore, measurement of eccentric data can be performed by sampling and carrying out the A/D conversion of this signal level by an encoder pulse, and incorporating by a microprocessor.

[0044]The eccentricity of the 1st layer and the 2nd layer can know the hand-of-cut position etc. which become equal like drawing 3 (F) by comparing the measured disk inside a microprocessor by these methods. This measurement is performed at the time of disk wearing, the position of the hand of cut of the optical disc 1 is continuously supervised during playback of a disk using the angle detection machine 6, and it is made to perform jump operation according to the timing determined beforehand at the time of a reproduction layer change.

[0045]Drawing 4 is the explanatory view which expressed the layer jump operation in this invention with the locus of the light beam spot on a disk. A spot locus when 31 are reproducing the track on the 1st information storage layer among a figure, As for a spot locus when 32 is tracing the track on the 2nd information storage layer, a spot locus when 33 cuts a tracking servo with an A point, and 34, the central point of the axis of rotation, and 36 and 37 are the eccentric coincidence directions the circumference of non-eccentricity, and 35. At the time of layer jump generating, the information storage layer which should be reproduced on the boundary of the data area shown in drawing 12 and middle area is switched using the eccentric data of the 1st and 2nd information storage layer memorized by the memory. When a tracking servo is cut, since tracking control is not performed, the spot locus 33 turns into a circumference locus of non-eccentricity.

[0046]Supposing a layer jump can carry out in an instant now, it is best to perform a layer jump in the position of the intersection B seen from the pickup side of the final track 31 on the 1st [of a jumping agency] information storage layer, and the reproduction start track 32 on the 2nd [of a jump destination] information storage layer. However, a layer jump takes the time for about about 30 to 40

ms actually. For example, the DVD disk is rotating by CLV of linear velocity 3.84 m/s, and is rotating one time in about 100 ms at the peripheral part. Therefore, while carrying out the layer jump, a disk will rotate about 1/3 - 1 / 2 round. Then, the time which a layer jump takes is considered, and it jumps so that it may become the point C from the point A. That is, it can jump in the position near the reproduction start track on the 2nd information storage layer by carrying out a layer jump between the point A that eccentricity is equal, and the point C.

[0047]Drawing 5 is the figure which expressed linearly the light spot locus explained by drawing 4. From the point A on the 1st information storage layer 31, a layer jump is carried out to the point A and the point C on the 2nd information storage layer 32 with equal eccentricity. Between the point A and the point C, since a tracking servo means is turned off, a pickup moves in the circumference top of non-eccentricity.

[0048]The jump starting point A explained by drawing 4 and drawing 5 and the jump end point C can be beforehand determined at the time of disk insertion. The determination flow is shown in drawing 6. According to the performance of the hardware, it decides on the time Tj required for a layer jump with the margin beforehand (for example, 40 ms). If a disk is inserted, while measuring the eccentric data of each information storage layer by S2, the start radius of the middle area memorized beforehand is read by S3 S1. From the start radius and the layer jump time required Tj of middle area, the angle which a layer jump takes is calculable by S4. Based on a calculation result, the timing of a layer jump is determined by S5.

[0049]Drawing 7 explains the deciding method of the point A and the point C further. The eccentric data 31 of the 1st layer (layer 0) and the eccentric data 32 of the 2nd layer (layer 1) are measured at the time of disk insertion, and are incorporated into the inside of a microprocessor. The layer jump time Tj is changed into angle information. The intersection of the data 31a in which only the layer jump angle shifted the eccentric data 31 of the 1st layer, and the eccentric data 32 of the 2nd layer turns into the landing site C of a layer jump, i.e., the point [one / a point / a tracking servo]. The point of the 1st layer before the shift corresponding to the point turns into the jump starting point A, i.e., the point which turns [track] off / kicks [focal]. Thus, the microprocessor keeps in mind the hand-of-cut position of the point A and the point C searched for, and uses it from the 1st layer at the time of the clinch to the 2nd layer. This intersection exists in the eccentric field by the side of right, and the eccentric field of a negative side, and as shown in a figure, it can also be made into jump starting point A' and landing site C'. The jump starting point A, the landing site C and jump starting point A', and landing site C' are calculated, and it may be made to choose either.

[0050]Although the above-mentioned explanation explained the angle from a reference slit as a parameter, of course, the time from a reference slit may be calculated as a parameter.

[0051]Next, the procedure of a layer jump is described. In drawing 4, if the end point of the data area of the 1st layer approaches, a microprocessor will count the slit pulse from an angle-of-rotation detector, and will supervise the angle of a disk. After completing reproduction of the data area and going into middle area, when the angle from the reference slit of the point A is detected, while a microprocessor turns off a tracking servo, it performs a focal kick (focusing jump). A focal kick is operation which carries out a focus on the 2nd information storage layer while performing operation which switches a focal side to the 2nd information storage layer from the 1st information storage layer. The tracking actuator must be held by the turned-off position at this time. Therefore, it may be made to lock the position of an object lens compulsorily by attaching a position sensor to an actuator etc.

[0052]If it detects that the position of light spot reached the point C of the 2nd information storage layer by the angle-of-rotation detector circuit 6, the microprocessor 13 explained by drawing 1 will make a tracking servo one again, and will resume reproduction of the 2nd information storage layer. As a result, since the accuracy of a layer jump improves in the case of the change in the 1st information storage layer [2nd] from an information storage layer, Since the rough seek operation covering tens to hundreds of tracks resulting from the difference of the eccentricity of the 1st information storage layer and the 2nd information storage layer becomes unnecessary, it is (latency speed) + (fine seek operation time).
It can reach to a target track in a short time of a chisel.
[0053]When measuring the eccentric state of the 1st and 2nd information storage layer beforehand as an embodiment of the invention, When a means to judge whether the maximum eccentricity is smaller than a predetermined value is formed and a small thing is able to judge, a layer jump can be performed without being based on the method explained by drawing 6. For example, tracking-off and a focal kick are performed promptly, without it being alike, respectively, and the eccentricity of the 1st and 2nd information storage layer waiting for the point A, in being small enough, and it is made to perform tracking one again, without waiting for the point C after the completion of a focal kick. By doing in this way, it is possible to shorten the time for a layer jump further.
[0054]When the inertia of an optical disc is large, in the time of acceleration of the spindle motor which rotates this, and rotation stops, etc., an optical disc is slippery on a turntable etc., and there is a possibility that the clamp angle of an optical disc may shift. According to a 1st embodiment described with reference to drawing 1, after wearing of the optical disc 1, when the physical relationship of the optical disc 1 and a turntable changes by generating of a slide, etc., there is a problem that the detected eccentric position will change. As the remedy, the method of providing the slit for angle detection in the optical disc itself is employable.
[0055]Drawing 13 is an outline lineblock diagram of the optical disk reproducing device of a 2nd embodiment of the optical-disk-recording playback equipment of this invention, and drawing 14 is a top view showing the optical disc of one gestalt of operation of the optical disk media of this invention. Among a figure, the same numerals are given to the same portion as drawing 1, and explanation is omitted. As for la, as for an information storage field and 41, a slit and 43 are basic slits photosensor and 42. In the optical disk reproducing device of this embodiment, the point using the angle mark and the photosensor 41 for getting to know the position of the hand of cut established in the optical disc 1 as an angle-of-rotation detection means is different from a 1st embodiment.
[0056]As shown in drawing 14, to the field of inner peripheries other than the information storage field la of the optical disc 1, or a peripheral part. The slit 21 on the rotary encoder 4 shown in drawing 2 and the same slit 42 are formed at equal intervals, and shape, reflectance, or transmissivity is changed and it forms so that it may become the basic slit 22 which showed drawing 2 one slit in it, and the same basic slit 43.
[0057]Like the slit 21 on the rotary encoder 4 which detected the position of each slit with the photosensor 41, and was explained with reference to drawing 3, and the basic slit 22, It is detected whether the eccentric state of each information storage layer detected from the tracking error signal is in the position of the how many slits 42 from the basic slit 43, The timing which measures the eccentric data of the 1st and 2nd information storage layer, and operates tracking-off, a focal kick, tracking one, etc. is detectable.

[0058]The slit 42 and the basic slit 43 can be created by the means of forming as unevenness at the time of masking at the time of vacuum evaporation of printing, metal, etc., and formation of a substrate. When cutting the original recording of the optical disc 1, a pit may be formed in slit shape and an angle mark may be provided in the position equivalent to the peripheral part in the middle area in the field of inner peripheries other than the information storage field la of the optical disc 1, or a peripheral part, or the information storage field la, etc. When this cuts the portion which forms the slit 42 and the basic slit 43, What is necessary is just to record by making a recording laser beam turn on and off so that the original recording of the optical disc 1 may be rotated by CAV (Constant Angular Velocity) and a pit may be formed in the predetermined angular position at slit shape. If this method is used, an angle mark can be succeedingly formed in cutting of the information storage field la.

[0059]As a method of forming an angle mark in the optical disc 1, the reflecting layer of the peripheral part of the optical disc 1 can also be burned off and formed in slit shape by an YAG laser etc. The photosensor 41 detects change of the reflectance of the angle mark formed in the optical disc 1 as was mentioned above, transmissivity, etc., and the angular position of the hoop direction of the optical disc 1 is detected.

[0060]Like this embodiment, when recording the angle mark on the optical disc 1, it is necessary to equip a recording and reproducing device with the angle signal reading means of photosensor 41 grade. However, since the photosensor 41 is always supervising the position of the slit 42 of the optical disc 1, and the basic slit 43 even if the optical disc 1, the axis of rotation 3, or physical relationship with a turntable shifts during playback, an exact minimum eccentric position is detectable.

[0061]Although the layer jump in the case of clinch seamless reproduction of an opposite track path was made into the example and explained by explanation mentioned above, Since the track position in the information storage layer of a jump destination is not influenced with the eccentricity of an information storage layer also when between two information storage layers carries out a layer jump for the other purpose, seek operation which looks for the track which should be carried out record reproduction next can be performed in a short time.

[0062]In the explanation mentioned above, since DVD-9 and DVD-18 were made into the example, information storage layers were those with a two-layer disk, and an optical disc only for playback. However, the number of layers can perform at least three or more layers of layer jumps similarly. DVD-RAM of the over write using DVD-R of a write once method and a phase change as a recordable optical disc of two or more layers is proposed, and it is possible for it to be made to perform the layer jump by this invention similarly in these cases.

[0063]

[Effect of the Invention]According to the invention according to claim 1, the timing of the change of an information storage layer made into the object of record or reproduction so that clearly from the above explanation, Since it has a focal tracking control means in which the eccentricity of the end track before a change and the start track after a change has a focusing jump function for which it opts at the point which becomes equal, it becomes possible to jump directly in the position near the start track after a change.

[0064]Thus, since the accuracy of a layer jump improves, the rough seek operation covering a multiple track resulting from the difference of the eccentricity of the information storage layer before a change and the information storage layer after a change becomes unnecessary, and it is effective in the ability to reach to a target track only by fine seeking in a short time. As a result, the time which the change of an

information storage layer takes is shortened, and it becomes possible to reduce the capacity of a buffer memory required for seamless reproduction.

[0065]According to the invention according to claim 2, the rotary place detection means of optical disk media, It has an eccentric detection means which can measure eccentricity from the tracking error signal of a tracking servo means for two or more information storage layers of every, It is effective in the point that the eccentricity of the information storage layer before a change and after a change becomes equal being computable by the eccentricity information outputted from the output of a rotary place detection means, and an eccentric detection means.

[0066]In [according to the invention according to claim 3] claim 2 optical-disk-recording playback equipment, As movement timings between information storage layers, the intersection of the eccentric data of the 1st information storage layer and the eccentric data of the 2nd information storage layer which shifted only the angle theta which optical disk media rotate is made within a time [required for movement between layers] with a layer move end point, The optimal end point of a start for a layer jump is computable so that only theta may make a front angle the layer move starting point from the point.

[0067]According to the invention according to claim 4, the position of the hand of cut can be detected, without a rotary place detection means adding exceptional composition to optical disk media by detecting the angle mark formed in the solid of revolution interlocked with the driving shaft which drives optical disk media.

[0068]According to the invention according to claim 5, a rotary place detection means by detecting the angle mark formed in optical disk media, Since the position of a hand of cut is detected, even if optical disk media, the axis of rotation, or physical relationship with a turntable shifts at the time of the acceleration under record or reproduction, and rotation stops, etc., it is effective in the position of the hand of cut where eccentricity is exact being detectable.

[0069]According to the invention according to claim 6, since it has an angle mark which expresses the position of a hand of cut to the field of a peripheral part and its neighborhood, it is effective in the position of the hand of cut of the optical disk media with which a recording and reproducing device is equipped and which rotate being correctly detectable.

[0070]Although the technique of having specified two points which become equal [the eccentricity in an above-mentioned method] as the minimum eccentric position (zero crossing point [of drawing 4 and drawing 5] B) of each information storage layer was proposed by Japanese Patent Application No. No. 166313 [eight to], This invention has an advantage which can perform a layer jump rather than the above-mentioned proposal in a short time in order to determine a layer jump position in consideration of the time which a track jump takes.

[Translation done.]